

Luck versus Skill. How do we measure them? How should we use them?

Luck and Skill in Games

Luck vs Skill—Why do we care?

There is too much luck in this game, not 😞ough skill.
There is no luck at all in this game, it is e😞irely skill.



Games, Indeterminacy, Philosophy

- § Virtually every definition of game will state that indeterminacy is required
 - If they don't state it, they imply it
- § What 'creates' indeterminacy?
 - Randomness

Defining Luck and Skill

-  These properties of games are very difficult to define
-  They are also extremely counter-intuitive once you do define them

Overt Randomness



Part of a Table of Random Numbers

61424	20419	86546	00517
90222	27993	04952	66762
50349	71146	97668	86523
85676	10005	08216	25906
02429	19761	15370	43882
90519	61988	40164	15815
20631	88967	19660	89624
89990	78733	16447	27932



Dice



Cards



Random Number Generators

Game Theory & Politics



Rock is strong

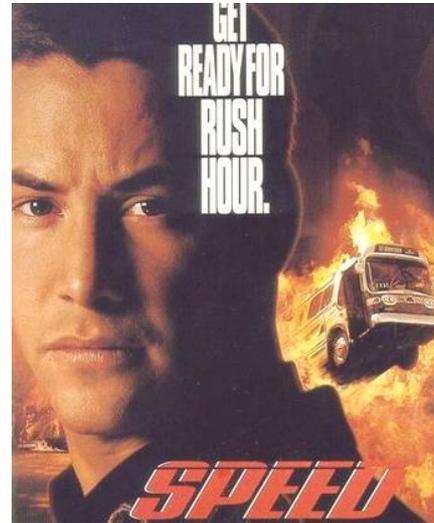
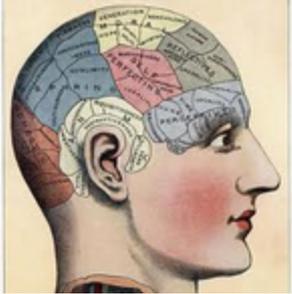


Simultaneous and hidden actions



Other players

Physical Limitations



Memory



Accuracy



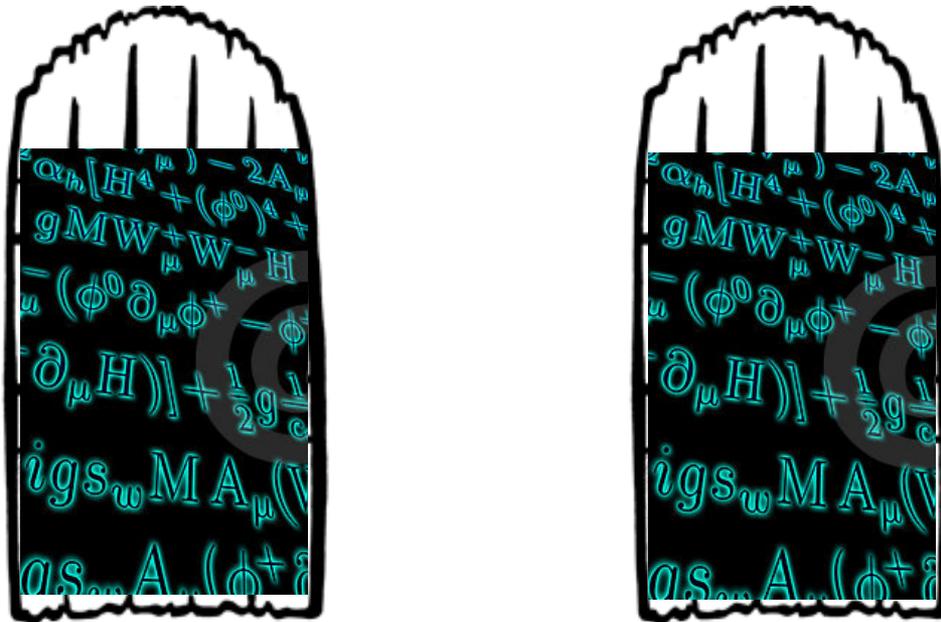
Speed



Strength



Complexity



If a person had to choose between 2 doors, one which lead to victory and the other defeat – there is no doubt there is luck.

Are there games without Luck?



Garfield vs. Kasparov



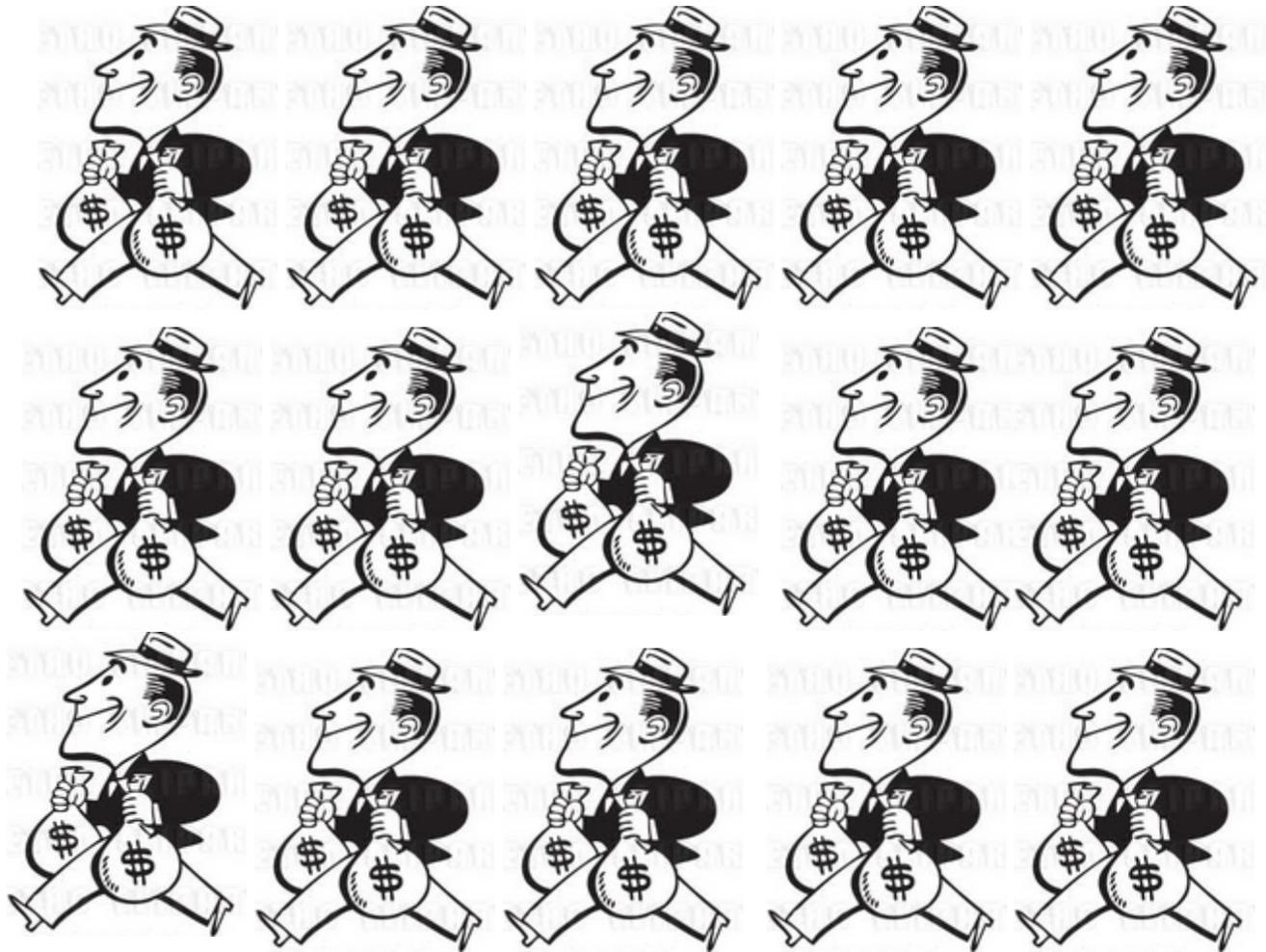
Winner



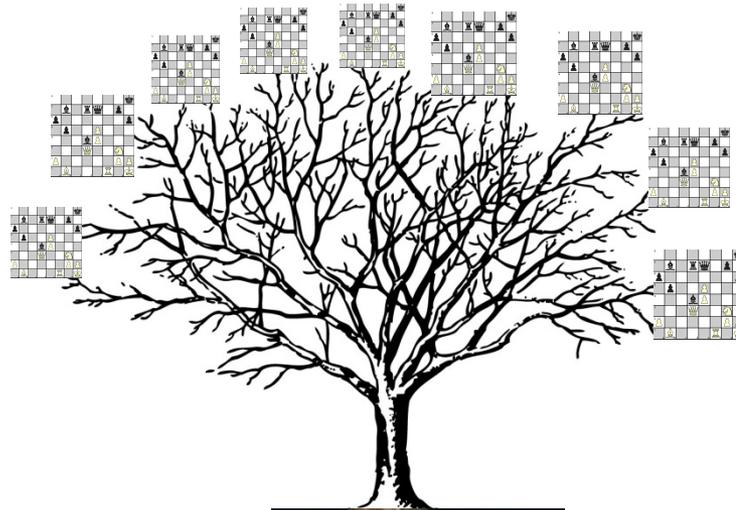
loser

Richard beats Kasparov playing randomly!

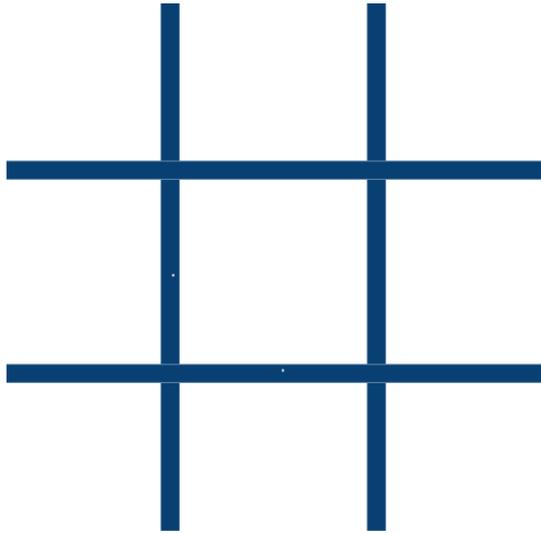
Though his chances of winning the New York State Lottery 15 times in a row are better.



Unless,...

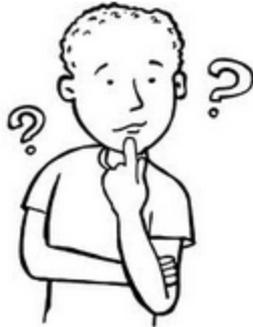


Luck hinges on Game AND Player



Pure Skill :Compute the Digit of π

50,347,200♪



A large number is given. Players have 30 seconds to determine what that digit of π is.

Pure LUCK :Compute the Digit of π

50,347,200

...72309400496726834795020938476641109384758475485288**7**613... π



A large number is given. Players have 30 seconds to determine what that digit of π is.

Pure Skill Game :Compute the Digit of π

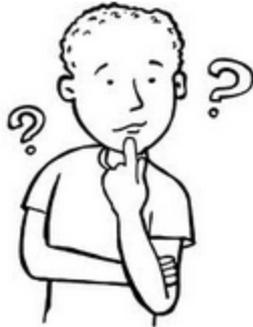
4thth♪



A large number is given. Players have 30 minutes to determine what that digit of π is.

Same game, changing amount of Skill

4th ♪



None in 2000BC, tons in 250BC, almost none in 2000AD

How do we define Skill?

-  The ability to do something well
-  The intrinsic ability to achieve a differential outcome
-  Skill is inherently defined as a comparison, even if only with your past self

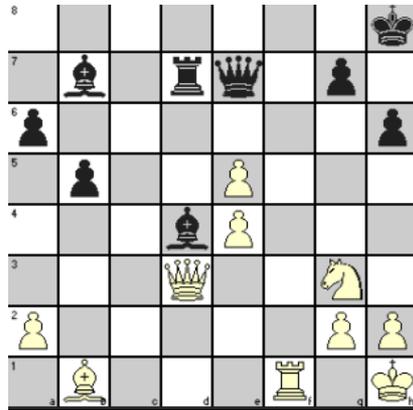
What does it mean to say game A has more skill than game B?



How do we measure skill?

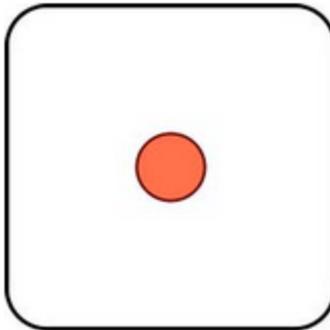
- Maximum win %? The pro “always” wins
- Chain of “levels” of skill, say a 75% win rate over another tier
- Elo, or similar rating
- The complete set of information is the true expected win % of each player over each other player, throughout time
- You must choose a slice, but choose wisely

Let's play: Rando Chess



Play standard chess but afterwards roll a die.

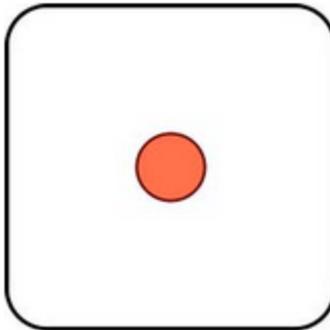
Let's play: Rando Chess



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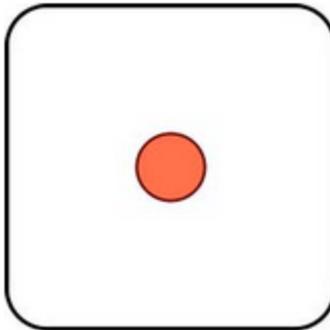
On a 1 the loser of the chess game wins the Rando Chess game.

Let's play: Rando Chess



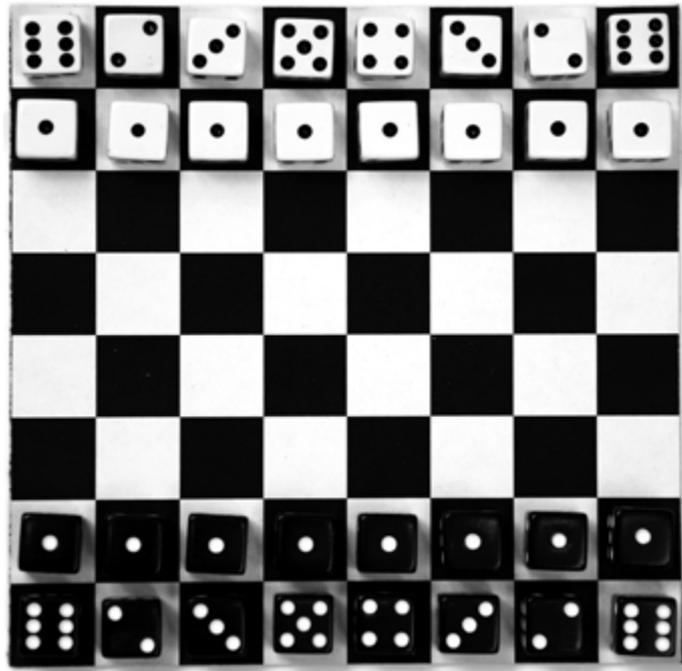
It is hard to argue Rando Chess has less skill than regular chess. But it obviously has more luck.

Let's play: Rando Chess



All previous skill is still useful. No player ranking change. With slight modification, “Elo” ratings are the same! Same world champion, same chess books.

A False Dichotomy



Luck vs Skill Graph

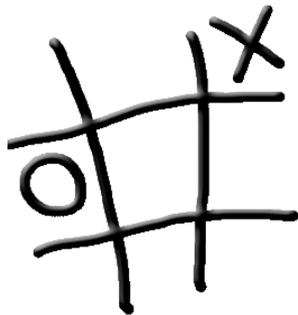


BINGO				
12	18	41	47	61
7	26	39	54	70
4	27	FREE 4785 SPACE	49	63
5	23	35	58	73
3	30	32	52	75

Bingo♪



Poker♪



Tic Tac Toe♪

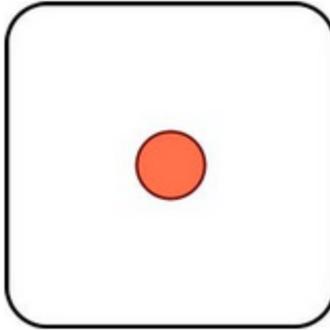


Go♪

Skill♪

Luck♪

What did change?: Rando Chess



- § Skill differentials became harder to measure. More trials are needed to get the same accuracy in rankings as before.
- § Another way to say it: less payoff for skill

Luck and Skill Interaction



 Is adding luck, thereby making skill harder to measure bad?

Luck and Skill Interaction



Players may reject the addition of luck. It moderates their reward.
What does your audience want? What's your value proposition?

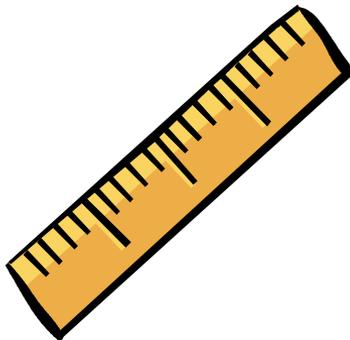
Luck and Skill Interaction

 The more time your audience puts into a competitive game, the more they may expect to be rewarded for



Luck and Skill Interaction

- ❑ Removing *all* indeterminacy makes your game very skill testing.
- ❑ For example, we can play “who’s taller?”

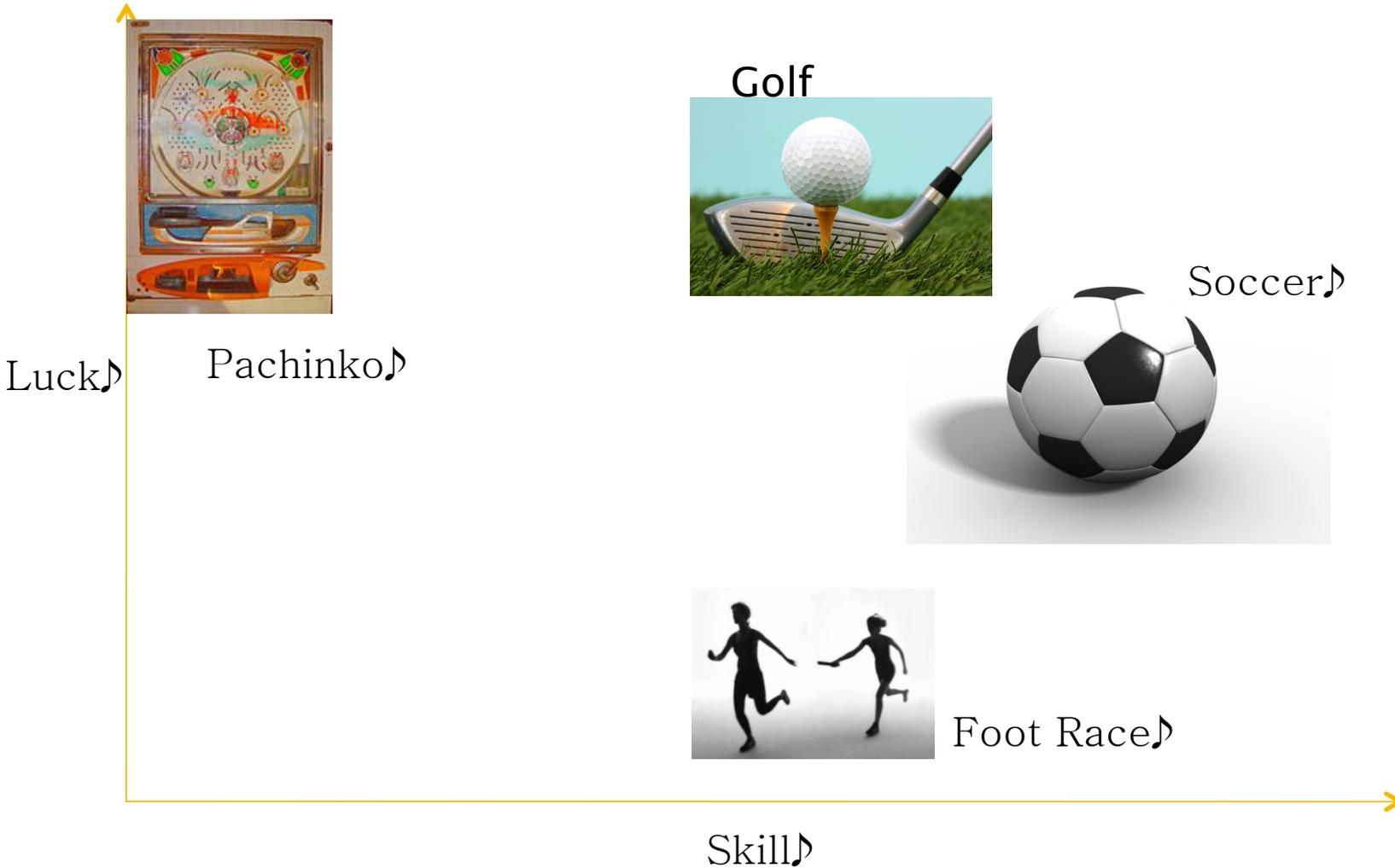


Luck and Skill Interaction



- ❏ But we no longer have a game, we have a measurement
- ❏ Which is fun to play at most once

Luck vs Skill Graph



Independent Benefits of Luck



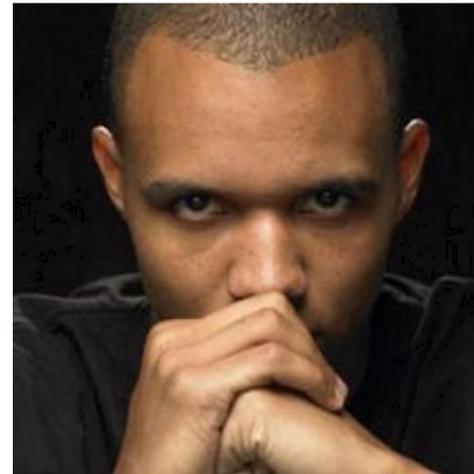
Player



Some psychographics are entertained by unexpected outcomes.

Luck and Skill Interaction

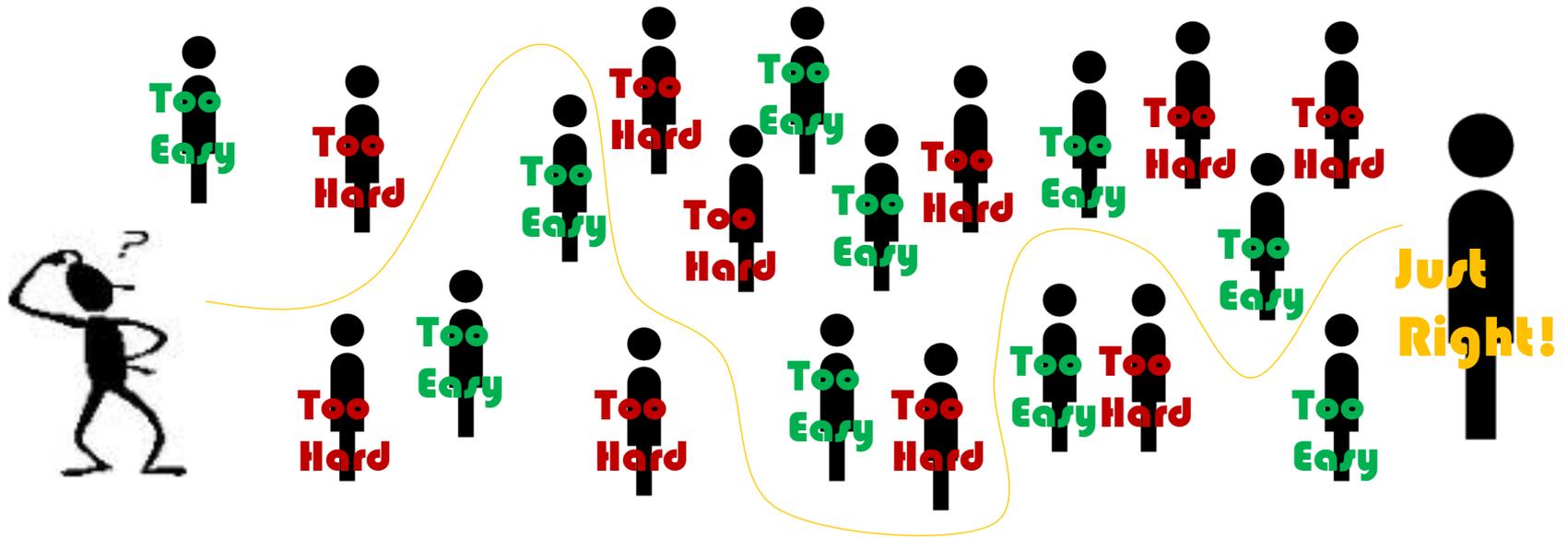
- Is adding luck, thereby making skill harder to measure good?
- Obfuscation of skill has many benefits
 - 1) In the best case, players blame their defeats on ~~luck~~ ~~and~~ ~~deep~~ ~~wisdom~~ ~~which~~ ~~is~~ ~~gained~~.



Luck and Skill Interaction

-  Is adding luck, thereby making skill harder to measure good?
-  Obfuscation of skill has many benefits
 - 1) In the best case, players blame their defeats on luck and wins on skill
 - 2) The amount of people you can have a fun (i.e. reasonably indeterminate) game with goes up greatly

Luck can Broaden Audiences



In a game with low luck it is more difficult to find an appropriately skilled opponent.

You risk losing all the time or winning all the time.

Luck can Broaden Audiences



You might get the desired opponent skill, but maybe not the desired



Luck can Broaden Audiences

 Is Phil upset about less payoff for skill in Poker?



Luck and Skill Interaction

The situation is incredibly complex. Any skill “curve” is possible, and while assuming player skill is defined by a normal (or any other) distribution with a single parameter is naïve, even if it is a practical necessity.

For example, some elements of luck may only be accessed with high skill (say a bonus level), and some may only be accessed by performing

Luck and Skill Interaction



Consider a Real Time Strategy game with randomized prices or technologies. Without randomness the community may decide it is all about Tanks. Players' rating may be based primarily on tactical skill and hand-eye coordination
Player A (Rating 2000), Player B (rating 1900), Player C (rating 1000)

Luck and Skill Interaction



With randomized prices
occasionally Dragons will be
viable



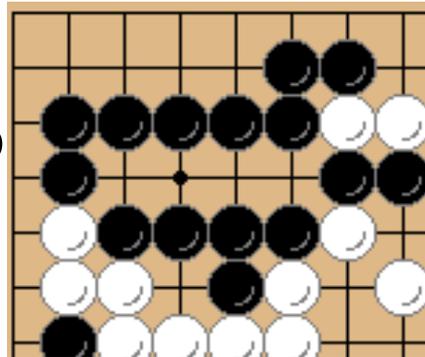
Luck and Skill Interaction



Who picks the dragon first?
Perhaps Player A can now beat
player B *more* often if skill has
been added in price efficiency.
But maybe Player A and Player C
move closer to each other in win
rate, if the strategic value of that
efficiency outweighs tactics

How to use the information

- Know your (intended) audience
- What is your key value proposition?
- How is your game going to be played?
Dinner table? Family room? Internet?
Solo?
- Does your revenue model require replays?
- Do your IP skill/luck i



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Characteristics of Games

CHARACTERISTICS OF GAMES

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